NUCLEAR ENERGY INSTITUTE

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U.S. Nuclear Regulatory Commission
Mail Stop 13-D13
Washington, D.C., 20555-0001

REFERENCE: Request for Comments on the Proposed Study on Spent Nuclear Fuel Cask Responses to Severe Transportation Accidents (Modal Study Update)

Dear Dr. Shankman:

The Nuclear Energy Institute (NEI),[1] is pleased to submit comments regarding the proposed study on Spent Nuclear Fuel Cask Responses to Severe Transportation Accidents. This proposed study is meant to revisit the conclusions of the study, "Shipping Container Response to Severe Highway and Railway Accident Conditions," NUREG/CR-4829, February 1987 (Modal Study), to ensure their continued validity.

NEI supports this proposal as a means of updating the original modal study to incorporate the latest advances in analytical technique and any additional information developed since the original study was completed. However, prior to moving forward with the proposed study, NRC should document its reasons for doing so and, in such publication, discuss the following:

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[1] NEI is the organization responsible for establishing unified nuclear industry policy on matters affecting the nuclear energy industry, including the regulatory aspects of generic operational and technical issues. NEI's members include all utilities licensed to operate commercial nuclear power plants in the United States, nuclear plant designers, major architect/engineering firms, fuel fabrication facilities, materials licensees, and other organizations and individuals involved in the nuclear energy industry.

- NRC's continuing confidence that the current regulatory framework for used nuclear fuel transportation cask design and certification is adequate to protect public health and safety.
- The extent to which NRC's confidence in existing regulations has been bolstered by the recently released Sandia National laboratory (SNL) report entitled "Re-examination of Used Fuel Shipment Risk Estimates" (NUREG/CR-6672).
- The relationship between the recently completed SNL Report and the proposed update of the modal study.
- Which areas of the modal study are being evaluated and why.
- NRC's objectives for bringing new information and risk informed insights into the regulatory process.
- Measurable benefits in areas important to safety that NRC hopes to gain by applying the latest technological advances to its regulatory research.
- Any physical testing or engineering modeling that will be conducted in support of this update and the specific purpose of each test or model. (See below for more specific recommendations for pre-testing documentation.)

Thirteen years ago, the original Modal Study concluded that used nuclear fuel cask designs would survive postulated severe transportation accidents without the release of radioactive material to the environment. The used nuclear fuel casks that are in use today, as has been the case over more than 30 years of demonstrated safe transportation, are designed based on current Nuclear Regulatory Commission (NRC) requirements and provide the highest degree of public health and safety protection possible. SNL's recently released report found the previous analyses that support NRC's existing requirements to be conservative. It concluded that the risks of used nuclear fuel transportation accidents are quantifiably less than what was believed to be the case when the original modal study was conducted.

Given the robust foundation that already exists for today's NRC regulations, NRC should focus its update of the Modal Study on those aspects of transportation cask design and analyses or transportation risk that have changed since the completion of the 1987 Study. These areas might include: physical testing of new materials or new designs to benchmark analytical codes, the use of modern analytical techniques, the use of updated accident data, etc.

In addition, NRC must also consider the impact of its update of the Modal Study on international regulations for used nuclear fuel package certification and transportation.

Specific comments on the six topics used for discussion purposes during the NRC's public workshops on this subject are provided below.

Highway and Railway Accident Likelihood, Sequences, and Scenarios

In assessing highway and railway accident likelihoods, NRC should ensure that the accident rate data realistically bound the probability of accidents in urban, suburban, and rural areas. This would alleviate the need for an exhaustive and unnecessary analysis of specific route conditions and provide a strong foundation for a conservative overall evaluation reflecting realistic rail and highway conditions expected during used fuel transport. NRC should draw upon the considerable detail available on highway and rail environmental conditions through the Geographical Information System (GIS) only to the extent necessary to establish confidence that the scenarios modeled are, indeed, realistic. Any update of the truck and train accident sequences should reflect real-world accident conditions and should not consider improbable or extraordinary events as part of the scenarios. If other modes of transportation, such as barge shipments, can be bounded by the truck and train accident sequences, separate analysis of these additional modes would not be necessary.

Sabotage is not an "accident" to which probabilities can be assigned, but is a deliberate act. Because of the fundamental differences in the methodologies for evaluating accidents and deliberate acts, NRC should continue to address this topic in other studies and related additional research as is already planned. It is neither necessary nor appropriate to include the issue of sabotage in the update of the Modal Study.

Container Performance during Collisions

The original Modal Study did not model cask closure response specifically due to the limited computation capabilities available at that time. To compensate for this uncertainty, the Model Study included conservative assumptions regarding used nuclear fuel release fractions. SNL has proposed modeling certain cask design features, such as the cask closure system, in more detail to take advantage of advances in computational modeling. If this is done, the conservatism in the used fuel release fractions should be adjusted accordingly to reflect the fact that there would be more certainty in the modeling of cask closure systems.

Regarding possible cask testing at speeds greater than 60 miles per hour, any tests performed as part of this study should reflect real-world conditions whether considering impacts with stationary objects, impacts with other vehicles or impact speeds. While a range of scenarios for possible collision sequences can be envisioned, it is not the speed at which the cask is traveling that is important but the force of the impact that must be absorbed by the cask. Accordingly, current regulations specify a 30-foot drop onto an unyielding surface. The forces resulting from such an impact

represent the relevant range of accident conditions. An assumption that a cask would impact an unyielding surface at these higher speeds would not be realistic.

Container Performance during Fires

NRC should apply real-world conditions for any accident sequences used to determine cask thermal response. SNL has proposed modeling an optically dense, one hour, 1000°C fire, as part of the package performance study. The regulations for used nuclear fuel transportation cask certification require testing cask response to a fully engulfing, 800°C fire for 30 minutes. Modeling and testing at conditions beyond what is called for in the regulations could be useful in providing additional data points to benchmark computational models and might also serve to bolster public confidence in the integrity of the casks. However, such tests are certainly "extra-regulatory". To the extent that such testing facilitates the evaluation of specific parameters that can strengthen the risk-informed insight that is applied to the regulation, these tests are appropriate. However, NRC should explain, before any tests are conducted, the purpose of such thermal tests and clearly state that any extra-regulatory test parameters should not be construed as regulatory conditions for cask certification.

Used Nuclear Fuel Assembly Behavior in Accidents

SNL has proposed the performance of laboratory-scale experiments that examine fuel rod failure and fuel pellet behavior during accidents. NRC should ensure that fuel characteristics used to calculate the source term realistically represent the range of possible fuel inventories with respect to fuel burnup, enrichment, and fuel age. Given the high cost of irradiated rod testing, NRC should identify, before moving forward, what risk-informed insights can be gained and consider the cost-benefit of any such proposed experiments.

Physical Testing and Computer Simulation

NRC's efforts to seek public input to the scope for the update of the Modal Study offer a unique opportunity for NRC to better understand the public's concerns and to attempt to address them. Consideration of public concerns in the development of the update to the Modal Study may help to formulate physical tests or analyses that can increase public confidence regarding used nuclear fuel transportation. NRC documents that address used nuclear fuel transportation risk must also put these risks into perspective with other risks that we encounter in our everyday lives.

Before any tests are conducted, NRC should carefully examine the potential public health and safety benefit of physical testing. NRC should clearly state the purpose

of any physical testing that is called for and thoroughly explain the relationship between physical testing and engineering modeling. Physical tests should be performed in conjunction with the proposed study as necessary to reflect changes in cask design, components, materials, etc. in order to benchmark analytical models used for cask design and analysis. However, due to the high cost associated with physical tests, NRC should consider the cost-benefits of any physical test proposed. Full scale cask testing can be useful to enhance public understanding of the severe accident performance of these casks. However, for the purpose of providing a benchmark for analytical codes, the use of scale models to test new components and materials may be more appropriate. In any case, the specific contribution of physical testing to the risk informed judgment that is applied in NRC's regulations needs to be understood. Accordingly, prior to beginning a physical-testing program, NRC should clearly identify – in advance:

- The purpose of the test (e.g., to perform benchmark calculations on an identified cask component or material);
- The acceptable testing requirements that would yield the results needed to meet the stated purpose (e.g., scale model parameter, type of test, etc.);
- The analytical codes planned to predict the physical test results;
- The testing parameters to be used during the physical test and the justification for the parameters used (e.g., fire temperature, drop height, angle of drop, etc.); and
- The estimated cost of the proposed test.

It may be beneficial for NRC to describe the role of physical testing and engineering analysis. For example, physical testing provides a limited number of data points that can be used to benchmark analytical codes to ensure that the predicted results are conservative. Engineering analyses using these analytical codes allows cask designers and regulators to look at multiple scenarios and determine safety margins.

Other Issues

The proposed study should use a risk-informed approach to determine the aspects of used nuclear fuel cask design that are most important to safety during severe accident conditions. The use of a risk-informed approach for the development of the proposed study will ensure that limited resources are used in the most cost-effective manner such that the major issues are addressed.

In summary, we believe that the safety of used nuclear fuel transportation has been demonstrated by the proven safety record during more than 30 years of safe used nuclear fuel transportation. The proposal to update the Modal Study should focus on strengthening the technical basis for used nuclear fuel transportation regula-

tions by: examining those parameters in the original study that have changed; updating computer modeling capability; and examining new cask designs, materials, and components.

We would be pleased to discuss these comments and to respond to any questions the NRC may have.

Sincerely,

Steven P. Kraft

cc: The Honorable Richard Meserve, Chairman, NRC
The Honorable Greta J. Dicus, Commissioner, NRC
The Honorable Nils J. Diaz, Commissioner, NRC
The Honorable Edward McGaffigan Jr., Commissioner, NRC
The Honorable Jeffrey S. Merrifield, Commissioner, NRC
Dr. William Travers, Executive Director for Operations, NRC
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Mr. John Garrick, Chairman, ACNW
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